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System of Land Tenure in the Federated Malay States.

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Introductory.

This article, being specially written for a publication on Agriculture in Malaya, will deal almost exclusively with agricultural land. No information about mining land will be found in it.

Land Law.

The law governing the tenure of land in the Federated Malay States is the Land Code 1926, which came into force on the 1st of January, 1928, superseding the Land Enactment of 1911 and the Registration of Titles Enactment of the same year. The general system, both of alienation of land and of registration of title is based on the Torrens system of Australia, with only such variations as have been found necessary to suit local conditions.

The Land Code divides land into the following categories:—

Town Land,
Village Land,
Country Land exceeding 10 acres in area,
Country Land not exceeding 10 acres in area,
Foreshore and sea bed.

All land which is not alienated, nor reserved for a public purpose, nor reserved forest, is State Land. State Land vests

in the Ruler of the State in which it is situated, and may be alienated only to

(*a*) an individual person, not being a minor,

(*b*) a company authorised by its constitution to hold land and incorporated under the Companies Enactment of the Federated Malay States,

(*c*) a company authorised as above, incorporated outside the Federated Malay States, which has complied with the provisions of the British and Foreign Companies Enactment 1912,

(*d*) a body corporate authorized to hold land and incorporated by any law in force, or constituted by Royal Charter or Letters Patent of His Britannic Majesty.

Organization.

For the purpose of land administration, as well as for other purposes, the States of the Federation are divided into districts, a list of which is appended to this article. (Appendix A).

Each district is under the charge of a District Officer, who for the purposes of the Land Code is a Collector of Land Revenue. With him are usually one or more Assistant Collectors of Land Revenue, whose powers under the law are the same as those of the Collector. In Kuala Lumpur and Seremban districts there are specialized Land Offices under the charge of a Collector of Land Revenue, and the title of District Officer no longer exists.

Town and Village Lands.

Town and Village lands may be conveniently considered together. They comprise all land within the limits of a town or village declared by law.

Title to town and village lands is either a Grant, or a Lease of State Land. A grant conveys absolute title in perpetuity subject only to an annual quit rent and the observance of the implied conditions under the Land Code together with the express conditions or restrictions in interest which may be imposed in the Grant. There are also certain rights reserved to the State on all alienated land. A lease conveys the rights and interests in the land set forth in the document

of lease, and is for a term of years decided in each case by the Resident.

Alienation of town and village lands is in almost all cases by auction, the successful bid including, as a rule, all payment for premium, survey fees, cost of boundary stones and preparation and registration of title. These items are usually included in the upset price. Quit rent is at the rate of $2/- per 2400 square feet on building lots, and on larger areas at the rate of $5/- an acre.

Country Lands Exceeding 10 Acres in Area.

Country lands exceeding 10 acres in area are alienated on Grant or Lease of State Land. The approval of an application for such land, as also the premium to be paid and the conditions to be imposed on the title are at the discretion of the Resident of the State in which the land is situated. As to premia it may be said in general that, except for oil palm land, of which mention is made later on, there is nothing in the nature of a fixed premium for agricultural land. All that can be said is that premia are generally lower in Pahang than in the other three States, owing to its larger area and less advanced stage of development. The day of purely nominal premia is however past, and at any rate in the three Western States, premia are made to bear some relationship to the market value of the land, particularly if it is to be alienated on Grant in perpetuity.

Quit rent on this class of land is $1/- an acre a year for the first 6 years, and thereafter $4/- an acre a year. There are provisions for rebate of rent for land planted with padi, or certain other approved agricultural products.

Survey fees are charged at a fixed schedule rate which will be found in Appendix B, and there are also small office fees payable for engrossment and registration of title.

Country Land not Exceeding 10 Acres in Area.

Country land not exceeding 10 acres in area is a division made in the interests of Malay or other small holders. Alienation of this class of land lies with the Resident, but he may delegate his powers to the District Officer. The title to such land may be a Grant or a Lease or an Entry in the Mukim Register.

A mukim is a subdivision of a District, and is under the control of a headman called a Penghulu. An Entry in the Mukim Register made by the Collector of Land Revenue in the manner prescribed by the Land Code gives a valid title to land. To every holder of land by this method is issued a copy of the entry in the register, known as an Extract from the Mukim Register, locally abbreviated into E.M.R. This extract contains a plan of a land made after survey.

European applicants for country land not exceeding ten acres however may expect to be given Grants or Leases.

For purposes of rent such land is divided into two classes, the rent being $1.60 to $4/- an acre on first class lands; and 80 cents to $1.20 on second class lands. In Pahang there are also third class lands the rent on which is 60 cents an acre.

The same considerations as to premium, survey and other fees apply here as to country lands exceeding ten acres.

Foreshore and Sea Bed.

The Code enacts that the title for land of this class shall be lease of State Land for a period not exceeding twenty years. The term sea-bed applies to the territorial waters of the State.

Applications.

Applications for State Land should in the first place be addressed to the District Officer of the District in which the land is situated. Applications are required to be made on a prescribed form, obtainable at all Land Offices, in duplicate. New applicants, especially if their requirements are for large acreages are well advised, before sending in any formal application, to seek an interview with the District Officer, or if that is impracticable, to enquire by letter as to the availability of land for the purpose required, at the same time informing him fully of their intentions for the development of the land and of the resources at their disposal.

The information in Appendix C as to the availability of land for agricultural purposes is given with the reservation that there is no guarantee that the areas mentioned will be still available. New applications are constantly being ap-

proved, and it will be understood that a list which may be up to date at the time of writing may very quickly need revision. In some cases moreover the availability depends to some extent on the extraction of timber, or the provision of drainage or communications. The wisest course is to refer personally if possible to the District Officer concerned before applying for land.

The investigations of the District Officer on an application will include enquiry as to the *bona fides* of the applicant, and the availability of the land for the purpose required. He will have to satisfy himself that the land is not reserved or likely to be required for any public purpose, that it is not a Malay Reservation, or a Forest Reserve, not likely to be required for mining, that it has or can be provided with some form of access.

The power to approve applications for State Land lies with the Resident in each State, but applications for areas exceeding 640 acres will be referred to the Chief Secretary to Government. Where the applicant is already in possession of 640 acres or over, any subsequent single application by him for land exceeding 100 acres will also be referred to the Chief Secretary.

Approval of Applications.

Approval of an application is conveyed to the applicant through the District Officer, who will at the same time call for the payment of premium survey and other fees, and quit rent. The nature of the title under which the land is to be held, and the express conditions if any, are conveyed at the same time.

Survey and Occupation.

On payment of fees, the District Officer will have the land surveyed by the Government Survey Department, and when this has been done will obtain from the Registrar of Titles the issue copy of the document of title and deliver it to the applicant.

Occupation of land in expectation of title may be allowed with the consent of the Resident if all fees have been paid and the boundaries marked out. In such cases however the approved applicant occupies at his own risk to the extent

that he has no claim to a greater area than stated in the application, and that payment of rent for the area applied for does not entitle him to a title for the whole extent of that area.

Cultivation Conditions.

The following is the section of the Land Code 1926 dealing with the obligation to cultivate country lands.

"36 (i) In the absence of an express condition to the contrary in the document of title to any land alienated under this Enactment there shall by virtue of this section be implied in such document of title the following conditions

(*a*) in the document of title for any country land of an area not exceeding ten acres the condition that the land be continuously cultivated in a proper manner after the methods of good husbandry to the extent of one-half of the total area thereof, and that if for three consecutive years such one-half shall not have been so cultivated the proprietor shall be taken and deemed to have made default in the observance of such condition.

(*b*) in the document of title for any country land of an area exceeding ten acres the following conditions

(1) that a *bona fide* commencement to cultivate the land shall be made within twelve months of the date of registration of the grant or lease of State land, and

(2) that the said land shall be cultivated in a proper manner and after the methods of good husbandry to the extent of one-quarter of the total area thereof at the expiry of five years from the date of registration of the grant or lease of State land, and to the extent of one-half of the total area thereof at the expiry of ten years from the date aforesaid, and

(3) that the said land shall thereafter be continuously cultivated in a proper manner and after the methods of good husbandry to the extent of one-half of the total area thereof, and that if for three consecutive years such one-half shall not have been so cultivated the proprietor shall be taken and deemed to have made default in the observance of such condition.

(ii) In the case of contiguous lots registered in the name of the same proprietor the area referred to in sub-section (i) shall be deemed to be the total area of such lots and the date so referred to shall be the date of the first grant, lease of State land or entry in the mukim register under which any of such lots is held.

Breach of the condition renders the land liable to forfeiture.

Quit Rent.

A few words as to quit rent. This is payable in respect of any year on January 1st of that year, without notice or demand by the Collector. Any quit rent not paid by the 1st April becomes automatically an 'arrear', and is recoverable, either by a notice of demand and attachment, or by a notice of attachment of the land. The former is a notice to pay the rent on demand, in default of which movable property on the land may be attached; the latter method is applied if for any reason the former has failed, or is not practicable.

Special Terms for Certain Products.

The following are the special terms at present in force for the cultivation of African Oil Palm:—

1. Premium.—$3/- an acre or such less sum as the Resident may approve.

2. Rent.—50 cents an acre for 6 years and $2/- an acre thereafter.

3. Export Duty.—2½ per cent. *ad valorem* or at such other rate as shall from time to time be notified in the Gazette.

4. Special conditions.—The land shall be used solely for the cultivation of African oil palm and such catch crops as are approved by the District Officer.

5. Cultivation clause (exceeding 640 acres)—One-quarter of the land shall be cultivated within five years and one-half of the land within ten years from the date of registration of the grant.

6. Labour clause (on areas exceeding 3000 acres).—The proprietor shall on or before import not less than labourers from any place outside the limits of the Malay Peninsula (alternately from India, from China, from Java, from any place outside the limits of the Federated Malay States, as may be determined at the time of approval of application). Upon proof to the satisfaction of the Resident that the proprietor has fulfilled this condition there shall if the proprietor shall so require in writing be endorsed hereon and signed by the Resident a memorandum to the effect that this condition has been fulfilled and that no further liability attaches to the land in respect thereof.

No fixed terms have yet been decided upon for roselle, sisal or tea, but special terms would no doubt be granted to any cultivator of these crops on an extensive scale.

A rebate of annual quit rent is allowed, if claimed by the owner of any country land exceeding 10 acres planted with coconuts or any approved agricultural product other than para rubber, tapioca or gambier. The rebate is such as to reduce the rent (normally $4/- an acre on planted land) to $1/- an acre, if the crop is padi, or $2/- an acre if the crop is any other approved agricultural product.

Conclusion.

In conclusion, it may be as well to point out that the information given in this article relates only to the Federated States. A perusal of the figures in the Appendix C will give rise to the reflection that, except in certain districts of Pahang, the amount of virgin land immediately available for

agricultural development on a large scale in the Federated States is becoming limited. There is still plenty of land to be had in Pahang, and also in the Unfederated Malay States, Johore, Trengganu, Kelantan, Kedah, Perlis and Brunei. Each of these States has its own land law, the main features of which are, as in the Federation, based upon the Torrens system of land tenure, though there will be found considerable divergencies in detail. Premia and rent will be found to be considerably lower, and, generally speaking land more readily available, in the Unfederated States. Land administration in each of these States is organized under officers of the Malayan Civil Service, and anyone interested is recommended to apply, for Johore to the Commissioner of Lands and Mines, for Trengganu to the Commissioner of Lands and Mines, for Kelantan to the Superintendent of Lands, for Kedah to the Director of Lands, for Perlis to the British Adviser, for Brunei to the British Resident.

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APPENDIX A.

List of Districts in the Federated Malay States.

State of Perak.

District.		Town.
Batang Padang	...	Tapah
Kinta	...	Batu Gajah
Krian	...	Parit Buntar
Kuala Kangsar	...	Kuala Kangsar
Larut	...	Taiping
Lower Perak	...	Teluk Anson
Upper Perak	...	Grik

State of Selangor.

Klang	...	Klang
Kuala Langat	...	Teluk Datoh
Kuala Lumpur	...	Kuala Lumpur
Kuala Selangor	...	Kuala Selangor
Ulu Langat	...	Kajang
Ulu Selangor	...	Rasa

State of Negri Sembilan.

Coast	...	Port Dickson
Jelebu	...	Jelebu
Kuala Pilah	...	Kuala Pilah
Seremban	...	Seremban
Tampin	...	Tampin

State of Pahang.

Bentong	...	Bentong
Kuala Lipis	...	Kuala Lipis
Kuantan	..	Kuantan
Pekan	...	Pekan
Raub	..	Raub
Temerloh	...	Temerloh

APPENDIX B.

Survey Fees on Town and Village Lots and Lands and Agricultural Lands.

	$	c.
5 acres and under ...	25	00
For each additional acre up to 10 acres ...	4	00
10 acres ...	45	00
For each additional acre up to 25 acres ...	3	00
25 acres ...	90	00
For each additional acre up to 50 acres ...	2	00
50 acres ...	150	00
For each additional acre up to 100 acres ...	2	00
100 acres ...	250	00
For each additional acre up to 200 acres ...	1	00
200 acres ...	350	00
For each additional acre up to 300 acres ...		90
300 acres ...	440	00
For each additional acre up to 500 acres ...		80
500 acres ...	600	00
For each additional acre up to 1,000 acres ...		70
1,000 acres ...	950	00
For each additional acre above 1,000 acres ...		60

In addition to the survey fees presscribed above, the following charges shall be payable for boundary stones and pipes and shall, in default of payment, be recoverable in the manner prescribed by Part XVIII of "The Land Code, 1926," for the recovery of sums due on account of rent.

	$	c.
For each boundary stone emplaced ...	1	00
For each pipe emplaced ...	3	50

In calculating survey fees an additional part of an acre shall be reckoned as an additional acre.

Provided that, in a case of any agricultural land not exceeding five acres, if the Collector is satisfied that the applicant has not the means to pay survey fees in accordance with this scale, the Collector may at his discretion remit such part of the survey fees (not exceeding two-thirds thereof) as he may consider to be proper.

APPENDIX C.

Areas of Prospective Agricultural Land in the Federated Malay States.

State of Perak.

District.	Area.	Remarks.
Kuala Kangsar	About 110 square miles.	About $\frac{1}{3}$ is between 1500 feet and 2000 feet elevation.
Krian	About 5,000 acres.	Mainly swampy land.
Upper Perak	Nil.	Mainly Forest Reserve and Malay Reservation.
Lower Perak	Some 20,000 acres possibly good for sugar.	
Batang Padang	Nil.	
Larut	Nil.	
Kinta	Nil.	Mainly given up to mining.

State of Selangor.

Kuala Lumpur	Nil.	
Kuala Selangor	Large area, but swampy and devoid of access.	Awaits drainage and communications.
Ulu Selangor	About 67,000 acres.	Not all immediately available.
Ulu Langat	About 10,000 acres.	Mostly hilly and devoid of access.
Kuala Langat.	About 42,000 acres.	Awaits drainage and communications.
Klang	About 1000 acres.	

State of Negri Sembilan.

Seremban	Nil.	
Coast	About 1,800 acres.	
Jelebu	About 30,000 acres.	Has first to be exploited for timber.

District.	Area.	Remarks.
Kuala Pilah	A few areas still available.	
Tampin	About 17,000 acres.	Not all immediately available.

State of Pahang.

Temerloh	About 350,000 acres.	
Pekan	Large areas available.	
Kuantan	About 130,000 acres.	Does not include inaccessible areas.
Kuala Lipis	Large areas available.	
Raub	Land is available.	
Bentong	Little land available.	

Artificial Farmyard Manure.

V. R. Greenstreet.

Any process which aims at producing in a simple manner something useful from otherwise waste material is deserving of attention.

The following article describes how waste vegetable matter may be transformed into a useful manure. Comparison with results of the original work on the subject carried out in England indicate that the process is much simpler in the tropics where vegetable waste requires no treatment besides the addition of water, the presence of air and the neutralisation of acidity.

The advantages of farmyard or cattle manure over so called artificial fertilizers are undisputed. Not only does farmyard manure satisfy the requirements of the plant for chemical nutrients but has a valuable physical effect upon the soil. The elimination of animal transport however is resulting in a gradual reduction in supplies of farmyard manure and has stimulated investigation at Rothamsted Experiment Station on its preparation using means other than animal metabolism. As a result of these researches a mixture of chemicals patented under the name of "Adco" has been put on the market. This mixture is claimed to possess the property of causing waste vegetable matter to rot rapidly and become in all respects an efficient substitute for farmyard manure. The fertilising value of such manure is naturally dependent upon the composition of the original material. During the process of rotting, plant nutrients contained in the vegetable waste undergo changes whereby they become easily available to the plant. A vegetable waste rich in plant nutrients yields a rich manure in the same way that cattle fed on food rich in plant nutrients yield rich cattle manure.

As it is generally conceded that its use is desirable in the cultivation of most crops any method for increasing supplies of farmyard manure or efficient substitute merit serious attention. The promise held out by the Adco process is important in Malaya where supplies of waste vegetable matter are so prolific. Investigations have therefore been carried out to study the applicability of the process under tropical conditions and the present article summarises the results so far obtained.

Experimental.—Experiments were first carried out with a view to studying the rotting of grass and dry padi straw alone as controls and with the addition of Standard ADCO, Vitic ADCO and sugar. In the experimental work carried out in England by the proprietors of Adco it was shown that in addition to its physical condition the reduction in pentosan content of the material was a satisfactory criterion of the completion of rotting[1]. In this investigation determination of pentosans were made by McCance's[2] colorimetric method. This method being empirical and including all furfural yielding substances, the term "pentosans" in this paper is intended to signify not only true pentoses but other easily decomposable compounds such as hexoses and hemicelluloses. Nitrogen was estimated by Kjeldahl-Gunning's method. Table I gives a description of the experiments and Table II the composition of the original materials.

TABLE I.

Description of Experiments.

Reference.	Material treated.	Treatment.
A	Grass cuttings	Standard ADCO added
B	Grass cuttings	None
C	Dry padi straw	None
D	Dry padi straw	Standard ADCO added
E	Grass cuttings	Standard ADCO added
F	Grass cuttings	Standard ADCO & 1 per cent sugar added
G	Grass cuttings	Vitic ADCO added

TABLE II.

Showing the composition of the original materials.

—		Grass Cuttings		Padi Straw	Standard ADCO	Vitic ADCO
		fresh	dry	dry	dry	dry
Moisture -	per cent	76	—	13	—	—
Ash -	per cent	—	7.6	17.9	73.4	39.0
"Pentosans-"	per cent	—	34	55	—	—
Nitrogen -	per cent	—	1.4	0.7	10.0	3.1

1 Private communication from Messrs. Adco, Ltd.
2 McCance, Bio. Chem. Journal, XX, 1926, 1111.

With the exception of experiment "E" the materials under investigation were placed in cages thus ensuring an unrestricted supply of air. Experiment "E" was conducted in a packing case with a view to conserving the supply of moisture, limiting the supply of air and rendering the conditions partially anaerobic and approximating to those which would obtain were the rotting carried out in a pit. The amount of material treated ranged from about 60 lbs. in the case of padi straw to about 500 lbs. in the case of the grass cuttings. When Adco powder was used about 3 per cent was mixed with the fresh grass and about 14 per cent mixed with the dry padi straw.

The experiments which commenced in August, 1926, were carried out inside a building and the rotted material sampled for final analysis in May 1927. Water was sprayed onto each container daily to compensate for that lost by evaporation and care was taken to avoid wash. The method of applying the water was found to be important. In the early stages the addition of water in buckets merely resulted in the formation of channels and as thorough wetting was vital it was found necessary to add the water in the form of a spray. It was subsequently discovered that the difficulty of thorough wetting could be largely overcome by giving the material a preliminary soaking by immersion. The moisture content was maintained between 70 and 80 per cent. In May 1927 all the samples presented the appearance of a peaty soil, were odourless and bore no resemblance to the original materials. Table III shows the composition of the products after rotting for nine months.

TABLE III.

Showing the composition of the products after rotting for nine months.

		A	B	C	D	E	F	G
Moisture -	per cent	68.4	81.8	73.9	70.6	79.0	78.6	82.8
Ash on dry material -	per cent	37.7	24.3	55.2	57.0	44.4	33.6	28.9
"Pentosans" on dry material	per cent	6.9	13.2	6.0	3.5	7.4	6.8	11.3
Nitrogen on dry material	per cent	2.5	3.1	1.6	1.6	2.0	2.5	2.9

The results are more significant if the figures in Table III are recorded to represent the changes in composition which the original material has undergone. On the assumption that there is no appreciable loss of mineral matter during rotting the reduction in weight may be calculated from the increase in the percentage of ash. The percentage loss of "pentosans" calculated on those originally present is a criterion of the degree of the rotting, and the value of the process may be gauged by the extent to which the nitrogen is retained by the product.

Table IV shows the comparative values of the various processes based on the analyses recorded in Tables II and III.

TABLE IV.

	A	B	C	D	E	F	G
Percentage loss of weight - -	60	69	63	42	63	62	65
Percentage loss of "pentosans" -	91	87	94	97	91	93	88
Percentage loss of nitrogen - -	58	29	22	64	68	55	35

Since it has been shown by previous investigators that a reduction in pentosan content of over 80 per cent may be regarded as a criterion[3] of satisfactory rotting, it may be concluded that the value of the various processes described varies only in respect of their conservation of nitrogen. According to Table IV therefore processes B and C are eminently satisfactory. It is evident that no significant improvement in rotting is affected by the addition of sugar or Adco, while in the presence of the latter a greater loss of nitrogen is found to occur.

In order to confirm these observations and at the same time investigate the possibility of utilising the refuse from pineapple-canning factories a further series of experiments was carried out at a local factory. Each experiment was conducted in the open on a heap of about 10 pikuls of macerated fresh

3 R. D. Rege, Annals of Applied Biology, 1927, XIV, 1.

refuse. Standard ADCO, Vitic ADCO, and ground limestone were added to the various heaps and the following tables show the composition of the material from week to week. For purposes of comparison, the composition of fresh refuse and that of refuse sampled at various depths from a "dump" and deposited more than one year previously are tabulated in Table V.

TABLE V.

Reference.	Description of materials.	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
A	Fresh refuse	95	7.3	56	1.78
B	Three feet below surface of dump.	90	5.8	25	1.96
C	Four feet below surface of dump.	90	6.2	38	1.37
D	Four/five feet below surface of dump.	90	11.4	20	1.92
E	Four/five feet below surface of dump.	88	12.8	33	2.05
F	Six/seven feet below surface of dump.	87	-	27	1.67
G	Six/seven feet below surface of dump.	96	11.5	23	1.50

The odour of the refuse sampled from the dump was very noxious. The experimental heaps became slightly odoriferous after two or three weeks but entirely odourless after four or five weeks had elapsed.

TABLE VI.

Pineapple Refuse.

Control: treated with 1 gallon of water per week.

Period of rotting weeks.	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
2	92	5.9	—	1.01
4	89	7.6	54	1.66
5	84	13.3	38	2.31
6	82	17.3	16	2.42
7	83	21.4	16	2.44
8	83	26.9	—	2.22
10	82	21.0	—	2.46
11	80	30.3	11	2.24

TABLE VII.

Pineapple refuse plus Standard "ADCO" 3 per cent.

Period of rotting weeks	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
2	89	13.9	—	1.77
4	86	21.7	26	2.28
5	78	30.5	24	2.80
6	77	32.2	10	2.99
7	68	38.0	8	2.65
8	70	36.2	—	2.75
10	72	37.7	—	2.56
11	71	31.5	8	2.62

TABLE VIII.

Pineapple Refuse.

Standard "ADCO" 3 per cent; powdered limestone 0.25 per cent.

Period of rotting weeks	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
2	90	13.1	—	1.53
4	85	16.4	30	2.11
5	81	24.3	26	2.39
6	75	28.7	12	2.79
7	74	31.0	8	2.66
8	74	38.2	—	2.58
10	75	30.4	—	2.30
11	72	33.6	9	2.46

TABLE IX.

Pineapple Refuse.

Vitic "ADCO" 3 per cent.

Period of rotting weeks.	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
1	88	8.5	57	1.91
2	88	9.4	55	2.02
3	87	15.7	52	2.59
4	83	21.2	22	3.35
5	79	24.8	—	3.44
7	77	31.6	18	2.92
8	70	34.0	19	2.60
9	60	36.3	8	2.72
10	55	35.3	8	2.56
11	61	38.4	—	2.59
12	62	34.7	—	2.72
13	59	35.4	7	2.57

TABLE X.

Pineapple Refuse.

Vitic "ADCO" 3 per cent; powdered limestone 0.25 per cent.

Period of rotting weeks.	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
2	89	14.1	—	2.52
4	82	22.7	28	2.87
5	75	26.9	22	2.80
6	73	34.9	7	2.57
7	62	34.0	9	2.46
8	68	37.4	—	2.48
10	60	34.5	—	2.58
11	68	33.5	9	2.62

TABLE XI.

Pineapple Refuse.

Powdered limestone 0.25 per cent; 1 gallon of water per week.

Period of rotting weeks.	Total moisture per cent.	Mineral ash calculated on the dry material per cent.	"Pentosans" calculated on the dry material per cent.	Nitrogen calculated on the dry material per cent.
2	92	6.9	—	0.99
4	88	13.5	41	1.26
5	85	19.8	28	2.08
6	84	18.4	14	2.83
7	82	22.9	12	2.39
8	80	—	—	2.12
10	92	22.5	—	2.41
11	79	29.9	11	2.37

From the figures recorded in Tables 5 to 10 it can be seen that the ash and nitrogen contents increase from week to week until a maximum is reached about the seventh week after which there is a tendency for the values to diminish. The rate of decrease of the pentosan content falls off after the seventh week and if the rotting period is extended beyond this a further reduction in the pentosan content is accompanied by an incommensurate loss of nitrogen.

For the purpose of comparing the various processes with one another, making comparison with refuse sampled from the "dump", and relating the results to those recorded in Table IV the changes taking place until the seventh week have been calculated in the manner previously described.

TABLE XII.

Pineapple Refuse.

Change in composition of experimental heaps.

Experiment No.	6	7	8	9	10	11
Percentage loss of weight -	67	-	-	53	50	46
Percentage loss of "pentosans" -	91	86	86	85	92	89
Percentage loss of nitrogen -	56	67	67	60	60	27

TABLE XIII.

Pineapple Refuse.

Change in composition of refuse at various depths in the "dump".

Reference to sample in Table 5.	B	C	D	E	G
Percentage loss of weight -	-	-	36	43	37
Percentage loss of "pentosans" -	56	32	77	64	74
Percentage loss of nitrogen -	-	23	31	34	47

Consideration of table XIII shows that in the dump no approach to satisfactory rotting occurs to refuse at less than four or five feet from the surface which refuse must have

been deposited at least one year previously. Refuse sampled from a greater depth and presumably older shows no sign of further rotting and yet continues to lose nitrogen, both circumstances being probably attributable to anaerobic conditions.

It may be seen from table XII that experiment No. II, namely treatment with limestone, gave the most satisfactory results. The rotting as judged by the decomposition of "pentosans" is highly satisfactory and the loss of nitrogen less than that occurring in refuse in the dump. Confirmation is obtained of the conclusions drawn from the results of rotting grass and padi straw, namely that no appreciable advantage occurs from the presence of Adco.

Summary.

The results for the rotting of grass cuttings, padi straw and pineapple waste may be said to substantiate the claims made for Adco. It appears, however, that in the tropics and under the conditions described, these materials will rot equally well without the addition of Adco provided that the material is not markedly acid or, if so, its acidity is neutralised.

All the experiments described were carried out on material containing an excess of "pentosans" over lignin. The essential conditions for such material to rot efficiently may be summarised as follows:—

i. Neutralisation of acidity.

ii. A sufficient supply of air. This entails no special precaution in the case of grass-like material, but for more compact matter such as pineapple refuse in bulk occasional mixing is required.

iii. A moisture content maintained at 75 per cent or over. This presents no difficulty with such wet material as pineapple waste but in the case of padi straw or similar material a preliminary soaking is advisable.

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Jelutong.

C. D. V. Georgi.

Introductory.

An account was given in a previous number of this Journal, Vol. XV, 1927, No. 11, page 400 of an investigation carried out regarding the two types of deterioration liable to affect jelutong, namely the development of a black mould penetrating the material and resulting in the transformation of the interior of a block into a brownish-black sticky mass and the drying out of the material to a brittle mass. The second type of deterioration is usually referred to as oxidation, since it has been established that during the change the caoutchouc portion of the material absorbs oxygen, becoming converted into a resinous substance.

In that investigation it was shown that jelutong prepared from latex collected in the local forest reserves was unlikely to be affected by oxidation since a comprehensive series of experiments, using different coagulants and methods of treatment, had only resulted in the development of black mould to varying degrees.

Attention was also drawn to the fact that deterioration due to oxidation was the more serious of the two types and that further experiments were being carried out with latex from a locality associated with oxidation in order to ascertain whether this phenomenon is characteristic of the latex from a particular district, due possibly to botanical differences in the trees, or is caused by the addition of some substance to the material at some stage of the preparation, since a certain amount of unnecessary secrecy is still observed by some Asiatic producers regarding the details of the process.

In this connection the suggestion was put forward that the addition of small quantities of iron, copper and manganese salts to the latex before coagulation or the incorporation of these substances or the caustic alkalies, sodium and potassium hydroxides, with the fresh coagulum might induce oxidation, since it is well-known that the storage qualities of rubber are profoundly influenced by treating the latex or the coagulum

as suggested. Tackiness of the rubber is induced with eventual brittleness of product, the latter resembling the drying out or oxidation of jelutong.

With regard to a locality associated with oxidation it was understood from Messrs. L. A. Dreyfus & Co., Singapore, that jelutong from Kedah was particularly liable to this type of deterioration. Arrangements were therefore made to visit a concession near Jeniang for the purpose of carrying out coagulation experiments similar to those carried out previously with latex from the local forest reserves, the fresh coagula being brought back to the Department for further treatment and storage.

The writer was accompanied on this visit by Mr. H. Lincoln Houghton of the above firm to whom thanks are due for arranging the requisite supply of latex.

Although all these experiments are in some respects inconclusive it is considered advisable to publish an account at this stage, since the results serve to show that much further work is necessary before the causes of each type of deterioration can be definitely stated.

Experimental.

(a) *Coagulation with the addition of metallic salts to the latex.*

Blocks of jelutong were prepared by mixing 500 ccs. of local latex with 5 ccs. of 10 per cent solutions of the following metallic salts, ferrous sulphate, ferric chloride, copper sulphate, manganese sulphate and manganese chloride and coagulating with 2.5 ccs. of 10 per cent acetic acid, the correct amount of acid for this quantity of latex. The period of coagulation was extended to 4 days, since the weather had been wet during the few days previous to the collection of the latex and under such conditions it is advisable to allow an extra day for satisfactory coagulation.

Control experiments, in which the same amounts of latex were coagulated with acetic acid and alcohol, were also carried out.

The coagula were removed after four days and the excess serum squeezed out by moulding the material into blocks, which were shaped with a light wooden mallet. The blocks were allowed to drain for two days and weighed.

After six months the blocks were weighed and cut in two, the objects being to determine the moisture content of one portion in order to estimate approximately the loss of moisture for the whole block during this period and to subject the remainder of the block to a further storage test.

The results of examination showed that, although there was in every case a considerable loss in weight amounting to approximately 50 per cent, it was not possible to determine with any degree of accuracy the moisture content of the material owing to the changes that had occurred, and further it was unnecessary to continue the period of storage.

The results, which are summarised in Table I, show that both iron and copper salts induce oxidation in the material, manganese salts on the contrary appear to favour the development of mould. The effect of manganese on jelutong latex is therefore different from that found with rubber, in which these salts induce tackiness and brittleness of product with great rapidity.

A second series of experiments was carried out in which double the above quantities of the metallic salts were used, but the results were unsatisfactory. In several instances it was found that the effect of such a relatively large amount of metallic salt was to inhibit coagulation, even in the first series this inhibition effect is noticeable to a small extent in one or two cases.

Experiments have also been made in which varying amounts of iron in the form of ferric chloride have been added to latex in order to ascertain the minimal quantity of iron affecting jelutong on storage. The results show that jelutong to which an amount of iron equivalent to between 0.01 and 0.02 grams per 100 ccs. of latex is added oxidises considerably during three months storage. These experiments will be continued in order to ascertain whether it is possible to remove this iron by subjecting the coagulum to the usual refining process of boiling with water.

The effect of iron salts has a practical application as regards the preparation of jelutong on a commercial scale. Since coagulation of the latex is frequently carried out in kerosene tins it is important to ensure that such tins are free from rust so as to remove the possibility of the introduction of iron into the latex when the acid coagulant is added.

TABLE I.

Metallic salt and coagulant used.	Volume of latex. ccs.	Amount of metallic salt added grams.	Equivalent amount of metal per 100 ccs. of latex. grams.	Weight of fresh block. grams.	Weight of block after six months grams.	Loss in weight on storage. grams.	Condition of block after six months.
Ferrous sulphate ($FeSO_4.7H_2O$) and acetic acid ...	500	0.5	0.020	166	88	78	Material oxidised, except for outer surface.
Ferric chloride ($FeCl_3$) and acetic acid ...	500	0.5	0.035	197	100	97	Material completely oxidised.
Copper sulphate ($CuSO_4.5H_2O$) and acetic acid ...	500	0.5	0.026	198	87	111	Material oxidised, except for outer surface.
Manganese sulphate ($MnSO_4.5H_2O$) and acetic acid.	500	0.5	0.023	101	52	49	Mould development throughout block.
Manganese chloride ($MnCl_2.4H_2O$) and acetic acid ...	500	0.5	0.028	147	69	78	Mould development thoughout block.
Acetic acid	500	...	...	173	77	96	Mould development, not so marked as with manganese salts.
Alcohol	500	...	...	149	81	68	Satisfactory.

Further experiments will be carried out in which definite amounts of precipitated ferric hydroxide will be added to latex before coagulation and portions of the material will also be refined in order to ascertain whether the effect of iron can be minimised by boiling the coagulum with water.

(b) *Addition of metallic salts and caustic alkalies to the fresh coagulum.*

One gallon of latex collected locally was coagulated by boiling with 4.6 ccs. of 10 per cent acetic acid, and the fresh coagulum divided into 9 parts. Each part was boiled with water in order to remove soluble organic substances, cooled and passed two or three times between crepeing rollers in order to reduce the moisture content.

The strips of crepe were cut in pieces and allowed to soak for one day in 1 per cent solutions of the following substances, ferrous sulphate, ferric chloride, copper sulphate, copper acetate, manganese sulphate, manganese chloride, sodium hydroxide and potassium hydroxide.

The wet pieces of crepe were then pressed into a block, the latter being dipped in warm water for a few minutes in order to soften the material and enable the block to be shaped. The blocks were allowed to dry for two days, weighed and stored for six months.

The results of the experiments, summarised in Table II, show that, although during the period a considerable reduction in the moisture content has taken place, these metallic salts and caustic alkalies appear to have little or no effect on the jelutong. This may be due to the resin in the material becoming tougher and more resistant as a result of the treatment in boiling water and being able to afford more protection to the caoutchouc particles. The slight discolouration produced by the iron and copper salts appears to be of little consequence.

(c) *Coagulation of Kedah latex.*

Definite volumes of this latex were coagulated with the correct amounts of the following coagulants, acetic acid, formic acid, sulphuric acid, potash alum and sodium silicofluoride. After standing for three days the coagula were brought back to Kuala Lumpur and divided into three parts. One part was shaped into a block and stored without further treatment. A second portion was passed two or three times between crepeing rollers, the crepe being then boiled with water, cooled

TABLE II.

Metallic salt or alkali used.	Weight of fresh block. grams.	Weight of block after six months. grams.	Loss in weight on storage grams.	Calculated moisture content of fresh block. per cent.	Moisture content of block after six months. per cent.	Condition of block after six months.
Ferrous Sulphate ($FeSO_4.7H_2O$) ...	220	159	61	...	...	Satisfactory, material faint brownish-yellow in colour.
Ferric Chloride ($FeCl_3$) ...	219	149	70	28.4	1.0	Satisfactory, material faint brownish-yellow in colour.
Copper Sulphate ($CuSO_4.5H_2O$) ...	236	195	41	28.8	11.8	Satisfactory, material faint greenish in colour.
Copper Acetate ($Cu(C_2H_3O_2)_2$) ...	230	164	66	...	...	Satisfactory, material faint greenish in colour.
Manganese Sulphate ($MnSO_4.5H_2O$) ...	218	161	57	...	...	Satisfactory.
Manganese Chloride ($MnCl_2.4H_2O$) ...	261	222	39	29.7	11.2	Satisfactory.
Sodium Hydroxide (NaOH). ...	223	171	52	...	...	Satisfactory.
Potassium Hydroxide (KOH) ...	250	191	59	28.1	4.9	Satisfactory.
Control with boiling water.	227	168	59	28.8	2.6	Satisfactory,

and shaped into a block. The third portion was boiled with water and pressed into a block. All blocks were allowed to drain for two days and weighed.

After three months the blocks were examined when it was found that no deterioration of either type had taken place in any block, although the weights of the individual blocks showed considerable decreases, especially those blocks stored without treatment.

It was noticed that the material was hard and had a distinct tendency to break short, especially those samples that had been stored without further treatment, but the jelutong regained its plasticity on immersion in warm water.

A series of experiments was also carried out in which the latex was coagulated by boiling with the correct amount of acetic acid, the coagulum being divided into three parts. One part was shaped into a block, a second portion was passed between crepeing rollers, the crepe being boiled with water and pressed into a block. The remaining portion was boiled with water and pressed into a block.

The samples were examined after three months when it was found that there were no signs of oxidation, although the material had become hard and had a tendency to break short.

Experiments in which 0.03 grams of iron in the form of ferric chloride was added to 100 ccs. latex showed that the jelutong whether coagulated by boiling or by standing for three days was almost completely oxidised after three months. Further, the development of this type of deterioration was not prevented by subjecting the material to the usual refining process of boiling with water.

A suggestion had been made that the addition of sodium chloride (common salt) to latex might cause oxidation in the product on storage, but the results of experiments, in which 0.1 gram of this material per 100 ccs. was added to latex before coagulation, were negative. As far as could be judged there was no difference after three months storage between this product and that in which acetic acid alone had been used as the control.

Experiments showed that the Kedah latex coagulated normally when poured into alcohol and the resultant product showed no tendency to oxidise on storage. It was found however that oxidation developed in such material, if the latter

were passed between crepeing rollers and the crepe pressed into a block. The development of oxidation under these circumstances will be confirmed in the next series of experiments carried out with this latex.

Remarks and Conclusions.

The above experiments show that jelutong prepared from latex in the local forest reserves is affected by oxidation if soluble iron or copper salts are added to the latex before coagulation. Similar effects are not obtained by soaking the coagulated material in solutions of these salts.

The addition of soluble manganese salts to latex before coagulation appears to favour mould development.

In view of the action of soluble iron on jelutong it is also proposed to carry out experiments in which definite amounts of an insoluble form of iron are added to latex in order to ascertain whether oxidation develops similarly in the resultant product.

Latex from Kedah appears to differ in its composition from latex from the local forest reserves, since experiments carried out with latex from the latter source have always shown the resultant jelutong to be affected by deterioration due to mould development, unless sodium silicofluoride is used as the coagulant or the coagulum refined by boiling.

A further series of coagulation experiments with Kedah latex will therefore be carried out to confirm the present results, while it is also proposed to investigate the possibilities of variations in some of the constituents of the latex and of botanical differences between the trees in the local forest reserves and Kedah.

Summary.

This article describes certain experiments in which metallic salts have been added to latex collected locally, thereby inducing oxidation of the product on storage.

2. An account is given of a series of experiments carried out with latex from Kedah in order to investigate the alleged tendency of jelutong from this locality to oxidise on storage.

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Preliminary Report on the Cultivation of Candle-nut at Serdang.

T. D. Marsh.

The Candle-nut, *Aleurites triloba*, syn. *A. moluccana*, known locally as "Buah keras", is a medium-sized tree indigenous to Malaya. This species of *Aleurites* produces an oil which is known in many parts of the world as candle-nut oil, but in the Philippines it is called by the name of lumbang oil.

Candle-nut oil is a drying oil, and is commonly used in the manufacture of paints, varnishes, soap and linoleum. It is also used as a wood preservative and to a lesser degree by Asiatics for illumination purposes, hence its name. The Malays frequently use small quantities of the cooked kernels in curries; the cooking probably destroys to a certain extent the poisonous properties which the kernels are known to possess.

The residue after the extraction of the oil from the kernels, being unfit for cattle food, is generally used as a fertiliser.

Previous Publications on Aleurites Species.

Previous papers on *Aleurites* species were published in the Malayan Agricultural Journal as follows:—

(1) "Oil from Aleurites Species" by C. D. V. Georgi, Vol. X, No. 8, August, 1922, describes experiments to determine the best methods of cracking the nuts and obtaining the analytical constants of the oil.

(2) "Candle-nut Oil from Aleurites Moluccana" by B. J. Eaton, Vol. XI, No. 5, May, 1923 in which the author gives a resumé of the markets for oil and oil cake, for the different *Aleurites* species.

(3) "Candle-nut and Chinese Wood Oil Trees" by W. N. Sands, Vol. XII, No. 1, January, 1924. The writer has compiled botanical and chemical facts and figures relative to the various species of *Aleurites* from publications on these crops, together with his own observations on the particular species growing in Malaya.

(4) "Oil from Aleurites Trisperma" by C. D. V. Georgi, Vol. XIV, No. 9, September, 1926, wherein is given the oil

content of the nuts, the physical and chemical properties are described and comparisons made with the oil from *Aleurites triloba*.

(5) "Oil from Aleurites Species" by C. D. V. Georgi, Vol. XIV, No. 9, September, 1926. The writer herein gives proposed new methods of cracking the nuts and separating the shells from the kernels, with the chemical properties of the resultant oil.

(6) "Chinese Wood Oil and Candle-nut Oil" by B. J. Eaton and C. D. V. Georgi, Vol. XIV, No. 11, November, 1926. This gives the origin and chemical properties of the two oils mentioned in the title of the article.

Experiments with Aleurites Triloba at Serdang.

The present report gives the results to date of a field trial conducted on a block of 8¼ acres at the Government Experimental Plantation, Serdang.

Germination of Seed.

Seeds were obtained from Khota Tampan Estate, Upper Perak, F.M.S., in March, 1922, and planted one foot apart each way in shaded nursery beds. It was soon observed that shading was unnecessary to the young plants and that germination was more rapid in beds fully exposed to the sun. The records show that over 75 per cent of fresh nuts germinated, the average period of germination being six weeks. Other writers have recorded that germination is slow and that only a small percentage of the seeds germinate, but this difficulty appears to be overcome by sowing fresh seeds.

Planting in the Field.

An area of virgin land situated on the lower slope of a small hill, facing the West, was selected for planting this crop. After burning operations were completed the land was clean cleared of all timber. The soil consists of a light friable loam overlying laterite.

In November, 1922, the young plants were taken up with a ball of earth and transplanted in the field at a planting distance of 20 ft. x 20 ft. square, which represents 108 trees per acre. Subsequent observations have shown that this planting distance approximates to the optimum for conditions prevailing at Serdang.

When the plants were established the growth was very rapid and six months after planting the average height was six feet. About 15 per cent. of the young plants died and "supplies" were planted to fill the vacancies.

Sowing at stake in the field, by placing two seeds at each lining peg and removing the weaker plant later, is in all probability a practical proposition.

In July, 1923, the whole area was silt-pitted to prevent soil erosion, to conserve moisture, and at the same time to allow of better aeration of the soil.

Yields.

The trees commenced to flower in April, 1924, or about one year and five months after planting in the field, but it was not until a year later that any fruits reached maturity, when harvesting of the nuts commenced.

Flowers and fruits are produced during almost every month of the year, but the heaviest yield occurs about July and August.

From April to December, 1925, a crop of 444 lbs. of nuts was collected from the area, representing a yield of about 54 lbs. per acre.

The following table gives the harvesting returns during the 4th and 5th years after planting:

Month.	Nuts harvested during 1926.	Nuts harvested during 1927.
	lbs.	lbs.
January	18	59
February	32	—
March	20	96
April	25	132
May	180	140
June	257	144
July	264	280
August	296	1,627
September	249	—
October	178	1,254
November	—	—
December	—	—
Totals	1,519	3,732

It will be seen from the above figures that the average yield per acre during the year 1926 was 184 lbs., while that during 1927 was 453 lbs.

These yields are much lower than those quoted in Bulletin No. 20 of the Department of Agriculture and Natural Resources, Bureau of Forestry, Philippine Islands, in which it is stated that 50 to 150 kilograms of nuts are obtained per tree. The yields so far obtained at Serdang are insufficient to make the cultivation of the crop profitable, but as the harvested weights of 1927 have increased very considerably over those of 1926 it is probable that the maximum yield has not yet been reached.

The records at Serdang show that approximately 39 per cent. of the fruits contain one seed, 47 per cent. two seeds and 14 per cent. three seeds. A number of nuts examined in 1925 gave an average weight of 8.8 grams per nut.

Harvesting and Drying the Nuts.

When the fruits are ripe they fall to the ground and are left for some time, until most of the outside pulpy covering of the fruits is decayed, which leaves the nuts in a fairly clean condition. The hard shell of the nuts prevents to any great extent deterioration of the kernel and its oil content and unless the nuts are covered with earth in the process of weeding, or by erosion after heavy rain, they do not germinate.

After collection the nuts are spread out on the barbecue to dry and any remaining fruit coat is cleaned away, the nuts being further dried and packed in bags. The output from the plantation, which up to date has been very limited, is sold locally in the form of unbroken nuts. Considerable difficulty is experienced after the nuts are broken, in separating the kernels from the shells, owing to the fact that the seed coat adheres to both the shell and the kernel. Many methods have been devised to overcome this difficulty and reference to previous papers on this crop gives the results of several experiments connected with this difficult problem.

Habit and Growth of the Tree.

The average height of the trees in November, 1927, at 5 years old, was 25 ft. and the spread, i.e. diameter, averaged 22 ft. 9 ins., while the girth of the stem at 2 feet from the ground averaged 2 ft. 4 ins.

This species requires a sheltered situation as the wood is soft and brittle and a storm may do considerable damage to a stand of trees. In exposed situations shelter belts of other trees should prove useful. The block of *Aleurites triloba* at Serdang is situated in a very sheltered position, having a mature rubber estate on the West and a high hill on the East. In spite of this, when a heavy storm passed over the plantation during April, 1924, about 14 per cent. of the trees were damaged.

Pests and Diseases.

In November, 1925, the trees were attacked by a fungus which was identified by the Government Mycologist as a *Diplodia* species. The fungus spread rapidly and in a few cases individual trees were killed within two weeks. Spraying with Bordeaux mixture checked the disease. It has, however, been in evidence on many trees up to the present date and has to be constantly dealt with by remedial measures. This disease is no doubt a factor to be considered in the cultivation of this crop in Malaya and in all probability has much to do with the low yields recorded above. It is possible that the environment does not altogether suit this tree and that the *Diplodia* is attacking a species which is weakened by unsuitable soil conditions.

Extract from a Report on the Nuts.

The following is an extract from a report made by the Imperial Institute, London, in November, 1925, on nuts grown at the Government Experimental Plantation, Serdang.

"The nuts were of normal appearance and in good condition, they averaged 7.3 grams in weight, and were composed of shell 66 per cent. and kernel 34 per cent., the kernels adhered to the shell and were difficult to separate.

The kernels were found to contain 5.8 per cent. of moisture and to yield on extraction with light petroleum 62.1 per cent. of oil, equivalent to 65.9 per cent. from the moisture free kernels. This represents a normal yield of oil from candle-nut kernels."

The writer is indebted to Mr. E. A. Curtler for the records of this crop to the middle of 1926.

Received for publication 1st April, 1928.

Notes on Dolichos Hosei, syn. Vigna Hosei.

B. Bunting.

The cover plant *Dolichos Hosei* Craib, commonly known as the Sarawak bean, is indigenous to Sarawak, and was first introduced to Malaya by this Department so far back as 1913 through Mr. E. Hose of Sarawak, after whom it was named.

In an article published in the Agricultural Bulletin of the Federated Malay States, Vol. 1, 1913, p. 276, entitled "Notes on a Creeping Bean", Mr. E. Hose drew attention to a leguminous plant which had proved a great success on his estate in Sarawak when planted as a cover crop with rubber. In this article he describes the plant as a low-growing creeping bean forming a thick level mass about six inches thick on the ground. Further, he states that "it grows readily from cuttings, but seeds are very difficult to procure", a fact which was confirmed later when carrying out experiments with this cover plant at the Experimental Plantation, Kuala Lumpur.

This Department received a supply of cuttings from Mr. Hose in 1913 and at the end of that year specimens of the plant then under cultivation at Kuala Lumpur were forwarded to the Royal Botanic Gardens, Kew, for identification. As a result of an examination of these specimens, Mr. W. G. Craib, in an article entitled "A New Cover Crop" published in the Kew Bulletin, 1914, p. 76, describes the plant as *Dolichos Hosei*. In the course of this article Mr. Craib states that "in response to an enquiry from Kew the Director of Agriculture, Kuala Lumpur, forwarded specimens for identification. The specimens could not be matched in the Kew herbarium, and as they did not appear to agree with any described species of *Dolichos* they have been made the type of a new species—*Dolichos Hosei*—named after the discoverer". A full description of the plant *Dolichos Hosei* Craib (Leguminosae-Phaseoleae) then follows.

Some years later a new cover plant was reported as being cultivated in both Java and Sumatra under the name of *Vigna oligosperma* Backer, and in 1921 the Department obtained a supply of rooted cuttings of this particular plant from Dr. A. A. L. Rutgers of the Algemeen Proefstation der A.V.R.O.S., Medan for trial at the Experimental Plantation, Kuala Lumpur. As soon as the cuttings arrived from

Sumatra it was observed that they were very similar in appearance to *Dolichos Hosei* and a few months later, after the plants had become well established, the Economic Botanist of this Department made a critical examination of the two plants and then stated that he could not find any botanical characters which were sufficient to separate the plants into two distinct species. The result of this examination, therefore, supported the original possibility that *Dolichos Hosei* and *Vigna oligosperma* might be one and the same plant.

As a result of communications with the Netherlands Indies Department of Agriculture at Buitenzorg the fact was established that the plant originally described by Backer as *Vigna oligosperma* in 1916 was afterwards found by him to have been previously described by Craib as *Dolichos Hosei*, consequently he changed the name to *Vigna Hosei*.

In 1926 further specimens of the plant originally obtained from Dr. Rutgers under the name of *Vigna oligosperma*, were submitted to Kew for identification and as a result of a second critical examination it was found that the botanical characters of the specimens agreed better with Dolichos than with Vigna and therefore the original determination of *Dolichos Hosei* Craib must stand.

The present position is that while both the English and Dutch authorities freely admit that *Dolichos Hosei* and *Vigna Hosei* are one and the same plant they are still in complete disagreement with regard to its correct botanical classification.

The plant, which will continue to be called by its original name of *Dolichos Hosei* or the Sarawak bean, forms an excellent low-growing cover which is very suitable for cultivation with rubber, coconuts or oil palms. It is in fact considered to be one of the most suitable cover plants and possesses the dual advantage of forming a permanent cover which, under proper soil conditions, will thrive well under dense shade. Although the plant does not produce seed very freely in this country it can be readily propagated from cuttings.

Forecast of Oil Palm Crop in Malaya, 1928.

The yield in tons of palm oil and kernel from estates in Malaya, since production first started is as stated in the following table:—

Description of product.	Year.				
	1923	1924	1925	1926	1927
Palm oil ...	195	286	536	751	915
Palm kernels ...	50	81	110	168	185

A forecast of the probable crop which will be obtained in 1928 was obtained at the beginning of June, 1928. From the returns received, which include all estates in bearing, the estimate is 1,382 tons of palm oil and 327 tons of kernels. These figures represent increases of 51% of palm oil, and nearly 77% of kernels over the crops of 1927. This satisfactory increase is due to the fact that two additional centrifuge plants will be in operation, and to the increase in area brought into bearing.

D. H. G.